Dual

Edition March 1980

Service Manual

C 830

Technical data

The unit meets or surpasses the requirements of DIN 45 500 concerning HiFi home studio equipment.

Tape speed	4.75 cm/s
Deviation from correct speed	±0.7 %
WOW and flutter	
W.R.M.S.	±0.035 %
According to DIN playback only	±0.07 %
According to DIN record/playback	±0.10 %
Frequency response (with reference to DIN tolerances)	
Fe-tape	20 – 17 000 Hz
CrO_2-tape	20 – 18 000 Hz
FeCr-tape	20 – 19 000 Hz
Metal tape	20 – 20 000 Hz
Rumble weighted signal-to-noise ratio	
	with Dolby NR
Fe	67 dB
CrO_2	67 dB
FeCr	69 dB
Met	69 dB

Channel separation at 1000 Hz	
Between stereo channels	40 dB
Between opposite channels	70 dB
Erasure at 1000 Hz	70 dB
Oscillator frequency (push-pull oscillator)	105 kHz
Inputs (sensitivity for 0 dB)	
Microphone (1/4" coax. jack)	0.3 mV/ 5 kOhm
Receiver/amplifier (DIN-jack)	1 mV/10 kOhm
Receiver/amplifier (RCA-jack)	80 mV/47 kOhm
Outputs	
Receiver/amplifier (DIN-jack)	580 mV/ 5 kOhm
Receiver/amplifier (RCA-jack)	580 mV/ 1 kOhm
Headphones (1/4" coax. jack)	4 – 2000 Ohm
Fast wind time for C 60 cassette	60 seconds
Tape motion monitoring (electronic) switch-off time 1.5 seconds	
Line voltage	120 V and 230 V
Line frequency	50/60 Hz
Power consumption	approximately 15 W

Fig. 1 LED-Indicator

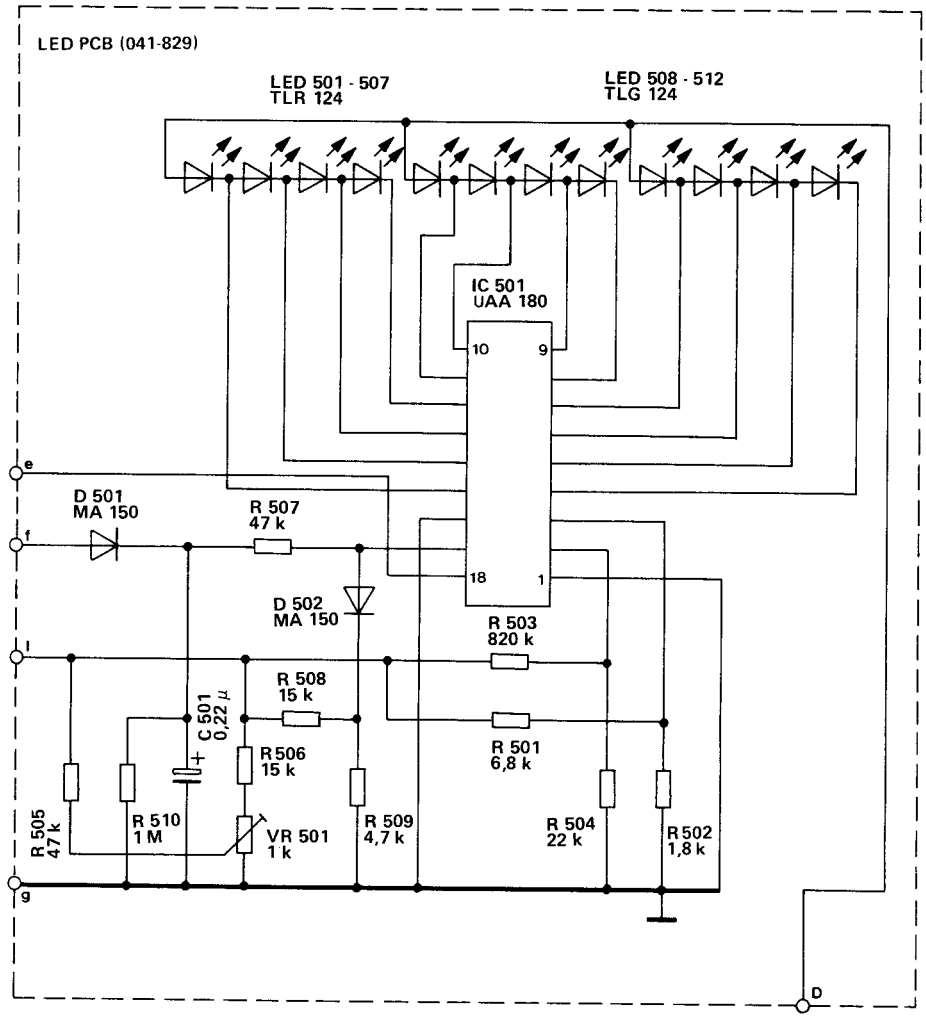


Fig. 2 Circuit of the Dolby amplifier the IC NE 646 B

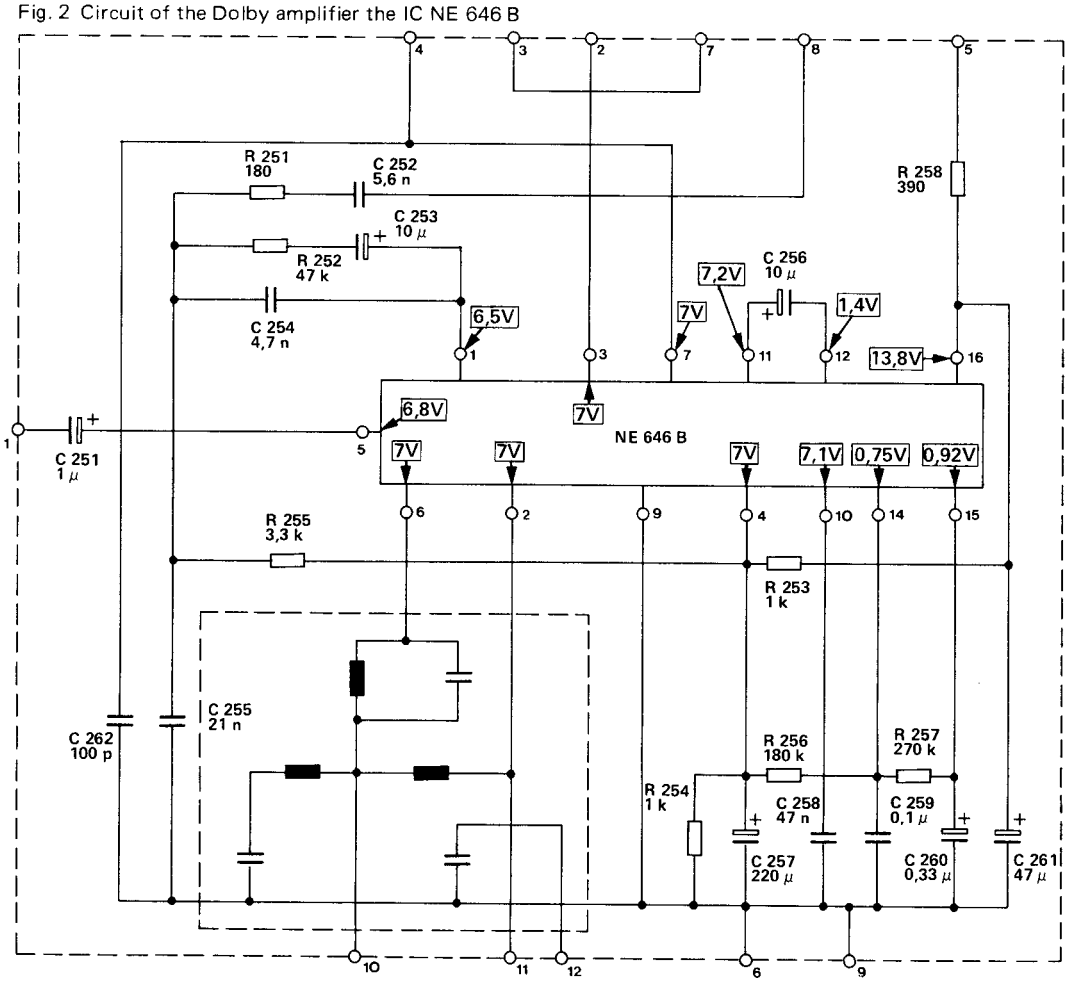
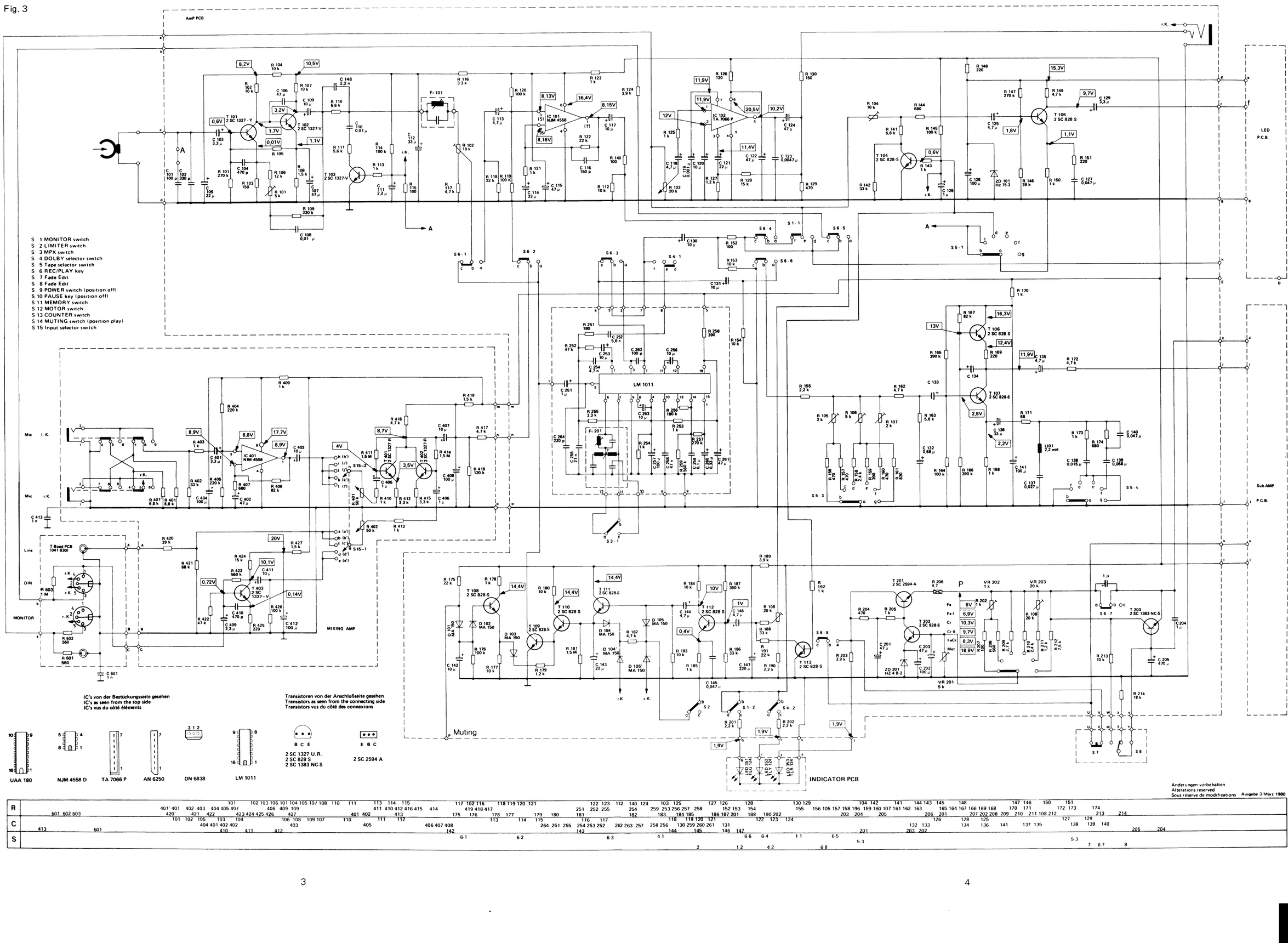


Fig. 3



Änderungen vorbehalten
Alterations reserved
Sous réserve de modifications Ausgabe 3/März 1980

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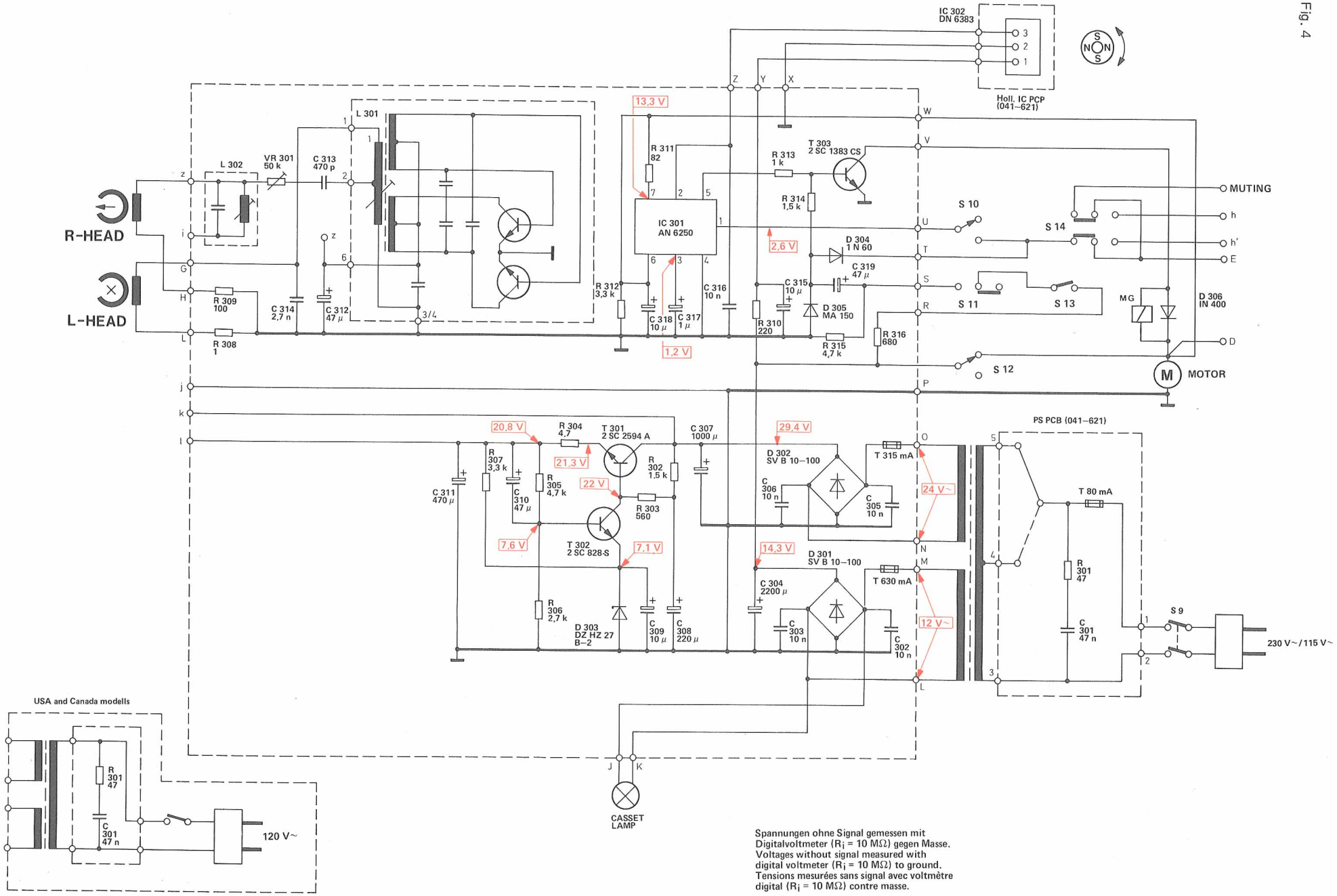
Fig. 4



Spannungen ohne Signal gemessen mit Digitalvoltmeter (R_i = 10 MΩ) gegen Masse.
Voltages without signal measured with digital voltmeter (R_i = 10 MΩ) to ground.
Tensions mesurées sans signal avec voltmètre digital (R_i = 10 MΩ) contre masse.

Functional description of electrical section

Playback

The voltage of approximately 300 µV induced in the magnetic head (during playback of the DIN reference level) is, firstly, amplified by T 101 and T 102 and is then accordingly equalized by degenerative feedback network R 106, R 109, C 108 and VR 101.

Midrange may be corrected using VR 101. By connecting or disconnecting C 101 or C 102, the magnetic head resonance may be altered, thereby altering the high frequency response. Playback equalization is switched from 120 µs to 70 µs by means of T 101. The playback level is set at 580 mV at the output jack by means of VR 102 by playing back the Dolby reference level (200 nWb/m). This is imperative for proper functioning of the Dolby circuit.

The playback signal now reaches the input of the Dolby circuit IC 251 via the record/playback switch S 6-1. If Dolby selector switch S 4-1 is switched off, the signal is amplified in a linear fashion by approximately 26 dB within the Dolby circuit, while with S 4-1 switched on, the signal is amplified depending upon frequency and level.

The output signal then travels from PIN 7 on the Dolby circuit via S 6-3 to the monitor switch S 1-1. In playback position, the "tape" signal is offered to the monitor switch via S 6-4 in position "source" in the same way. This ensures that the playback signal reaches the output jacks no matter what position the monitor switch happens to be in. The output signal is supplied to the headphone amplifier (IC 102) and amplified by approximately 22 dB by means of control VR 103.

In order to prevent switching noise reaching the output jack, the output signal is muted by switch S 14 if the start key is not depressed. Once the start key is depressed the signal through T 109 remains muted at the input to the Dolby circuit until the capstan reaches its rated speed in order to prevent "howling".

Recording

Three different sources are available for recording. These sources may either be recorded with the input selector switch S 15 in positions "Line", "DIN", "MIC" or may be mixed with each other with the input selector switch in positions "Line/MIC" or "DIN/MIC".

The signal at the Mic-input is amplified by low-noise IC 401 by approximately 43 dB. If only one microphone is used, the inputs are switched to "mono" through the switch jacks. The signal reaches the mixing amplifier T 401, T 402 via MIC level control R 401, where the input signal from the "Line"-input or from the DIN-input is mixed with it via R 402. The signal at DIN jack is amplified by means of T 403. This amplifier stage is designed to achieve very good signal-to-noise ratios if supplied with current in accordance with DIN 45 511.

From the output of the mixing amplifier, the input voltage now reaches the input to the Dolby circuit via S 6-2. If desired, a 19 kHz (MPX) filter may be connected between PIN 2 and PIN 6 of the Dolby integrated circuits using S 3-1. This suppresses any residual pilot frequencies when recording from radio. Such residual pilot frequencies could cause malfunction of the Dolby processor.

As opposed to playback, the signal which is unaffected by the Dolby process (PIN 3) is supplied to the monitor switch via S 6-3 and, with the switch in position "source", reaches the outputs. If the monitor switch is in position "tape", the information already recorded may be "off-tape" monitored via the playback channel and stage amplifier (IC 101). As bias crosstalk within the record/playback head is inevitable when operating in this mode, it must be suppressed by means of filter 101. As with the Dolby circuit, the amplification of the stage amplifier is approximately 26 dB in order to avoid differences of level between "tape" and "source".

If the Dolby switch S 4-1 is switched on, the output signal is "Dolbyized" at PIN 7 on the Dolby integrated circuits. The signal is supplied to the recording amplifier (T 106, T 107) via S 6-6. This recording amplifier affects the signal, aided by the tape selector switch S 5-3 depending upon the recording characteristics of the various tapes. The recording current for the individual tape types is set at VR 105, VR 106 and VR 107. The recording amplifier is designed as a current converter, i. e. the output current remains constant independent of the termination resistance. This means that the normally conventional high-impedance series resistor may be dispensed with, thereby achieving increased back-up saturation.

The recording signal is supplied to the magnetic head via wave trap L 302, where it is biased via VR 309. The HF oscillator (L 301) is fitted into a screening cover in order to prevent leakage to other units. It operates at a frequency of approximately 105 kHz.

The HF oscillator is triggered via T 201 which is affected by resistors R 207 . . . . R 212 and VR 202, VR 203, depending upon the position of the tape selector switch, resulting in the appropriate bias level.

The erasing current may be measured at R 308 and the biasing current may be measured at R 309. "Soft" fade-in of the HF oscillator may be affected during playback using S 7 and S 8 at time constants R 213 and C 205 ("Fade Edit").

Display and limiter

The output signal during both playback and record, reaches the display amplifier (T 105). In order to allow for increased saturation at high frequencies, a correction of frequency response is carried out via R 151 and C 127. At 10 kHz, boosting by 10 dB results from a rise of approximately 400 Hz. This is displayed via 12-stage LED chain, triggered by IC 501. The trigger signal for this integrated circuit is taken from the display amplifier, VR 104 setting the sensitivity and both D 501 and C 501 rectifying the signal. The –20 dB mark is set by means of VR 501.

The control signal for the limiter is supplied during record via S 6-5 to VR 108 which sets the operational cut-in point. T 112 amplifies this voltage and, with the switch in position "limiter off" (S 2) it is muted via D 105. With the limiter switched on, the control signal is rectified by T 111 and C 143. Via T 110, this voltage alters the incremental resistance of T 109 which, together with R 417, forms a voltage divider, thereby limiting the signal at the Dolby input to approximately 30 mV.

Tape selection

As the range of tapes available is increasing all the time, and, as metal tapes are also on the market, the C 830 was equipped with a 6-way tape selector switch. Additional positions "Fe I", "Cr II" and "Metal" have been added to the conventional settings Fe-, Cr- and FeCr-tape. The following is a corresponding list of typical types of tape and the switch position

Fe	–	BASF Super LH
Fe I	–	Maxell UD XL I
Cr	–	BASF chromium dioxide
Cr II	–	Maxell UD XL II
FeCr	–	Sony Duad
Met	–	3 M Scotch metafine

We have thus attempted to cover all types of tape available on the marked as far as possible.

Heads

In order to achieve best results with metal tapes, the heads must meet the most stringent requirements. The erase head is a twin-gap ferrite head, ensuring reliable erasure even at very low frequencies. The playback/record head has two electrically isolated systems, one for recording and one for playback which are, however accommodated in the same housing. The record and playback gap are only approximately 5.7 mm apart. This means that the recorded information may be monitored via the playback head after as little as approximately 120 msec.

In order to ensure a long useful life and, at the same time, good magnetic values, the material of which the core is made is a so-called "Sendust" alloy.

Limit switch

The limit switch has the job of switching off the unit when a cassette has reached the end of the tape. Furthermore, the unit must be switched off if the tape is not being taken up properly, e. g. owing to excessive friction within the cassette.

The information "tape running" is transferred to integrated circuit 302 by a 6-pole ring magnet secured to the drive pulley on the counter. This integrated circuit contains a Hall element which reacts to magnetic fields. The information is processed in integrated circuit 301, in which also the function „Pause" with switch S 10 passing the muting switch S 14 is supplied. If the magnet is stationary, there is a high pulse on Pin 5 of IC 301 output. This signal on the base of transistor T 303 causes switch over zero voltage to the coil MG which communicates in series with the driving motor. If the driving motor has been operated by switch S 12, the coils tension switches off the unit mechanically. By way of counterswitch S 13 in position „000" and memoryswitch S 11 is positive voltage connected with capacitor C 319. The function „Stop" is triggered due to the high pulse on the base of transistor T 303.

Power section

The power section supplied the electronic systems with a positive operating voltage of approximately 21 V which is stabilized by means of T 301. The motor is supplied with a nonstabilized voltage of approximately 14 v as there is a regulating circuit within the motor itself.

Electronic alignment

Necessary instruments and test cassettes

2 Millivoltmeters
1 AF oscillator
1 Oscilloscope
1 Frequency counter
1 Test cassette 400 Hz –20 dB, 10 kHz –20 dB
1 Test cassette Fe_2O_3 reference medium section, CrO_2 reference medium section
1 Test cassette 400 Hz Dolby level 200 nWb/m

General notes

Before adjustment, the magnetic head and all ferrous components which come in contact with the tape should be demagnetized.

Readjustment must be carried out in the sequence stated.

Note: during some alignment operations, resistors and capacitors are disconnected or inserted into the circuit via straps. These alignment operations are necessary in order to compensate for manufacturing tolerances and are carried out at the factory. They are only mentioned in the alignment instructions for the sake of being complete. (The alignment points are marked accordingly).

Playback

Magnetic head adjustment

Remove the cover plate on the record/playback head, insert the test cassette, section determined for gap adjustment, 10 kHz –20 dB.

Connect the millivoltmeters to outputs L and R (cynch jacks). If only one instrument is available, then connect the outputs in parallel.

Fe, ▶

With the set screw on the left-hand side of the magnetic head, align for maximum voltage.

After alignment, lock the adjustment screw with locking lacquer.

Note: with parallel switched outputs, secondary peaks will occur. Adjust for the maximum.

The difference between left and right channels at 10 kHz should be less than 3 dB.

Playback level

Insert test cassette, 400 Hz Dolby level

Fe, DOLBY NR, MPX, ▶

Adjust for 580 mV ± 0.25 dB in each case
For track 1 use VR 102 at cynch output L
For track 2 use VR 102' at cynch output R

Playback frequency response

Insert test cassette, 400 Hz –20 dB, 10 kHz –20 dB

Fe, ▶ (DOLBY: OFF)

Both level sections of the test cassette should have the same output voltage at outputs L and R.

Flattening the playback frequency response in the range of 4 kHz, related to 400 Hz, is possible using VR 101 (left channel) or VR 101' (right channel). This adjustment has been carried out at the factory and can only be carried out in conjunction with a DIN reference tape.

If a voltage rise at the 10 kHz –20 dB level as opposed to the 400 Hz –20 dB level is detected, connections A (left channel) and B (right channel) must be disconnected.

VU meter

Fe, RECORD, DOLBY NR, MPX, SOURCE, ▶

AF oscillator at input, millivoltmeter (AC) at output, record level regulators VR 402 and VR 402' (record level regulators LINE/DIN) fully clockwise.

Set AF oscillator to 400 Hz and adjust the level so that 580 mV is measured at both outputs L and R on the cassette deck.

Switch on the level indicator and adjust VR 104 or VR 104' so that the 0 dB LED comes on. Decrease the signal from the AF oscillator by 20 dB. The output signal at outputs L and R must be 58 mV.

Adjust potentiometers VR 501 and VR 501' so that the –20 dB LED comes on.
Repeat the alignment procedure as mutual influence is possible.

Background noise

Screen amplifier. Make sure that the magnetic head is free of hum.

Fe, PAUSE, ▶

Background noise at output L and R less than 3 mV, measured with 20 Hz filter (e. g. Sennheiser FO 55, curve 2, 20 Hz –3 dB) and RMS rectification of meter.

HF generator

MET, RECORD, ▶

Using a DC voltmeter, measure potential between point P (on the oscillator board) and earth and set 19 V using VR 201.
Connect frequency counter between point E-Cur (oscillator board) and earth and adjust the core of the oscillator coil (L 301) so that 105 kHz is indicated.
Set the tape selector switch to Cr II and set 110 mV (HF bias) at points L-CH bias, or R-CH bias using VR 301 (left channel) or VR 301' (right channel).

Set tape selector switch to Fe and adjust 63 mV at L-CH bias or R-CH bias using VR 202.

Set tape selector switch to FeCr and adjust to 85 mV at L-CH bias using VR 203.

Wave traps

Connect the millivoltmeter (AC) or oscilloscope to measurement points L-CH trap or R-CH trap and align to minimum HF voltage using coil L 302 or L 302'.

HF bias

Insert test cassette, CR II reference medium section (e. g. Maxell UD-XL II)

Cr II, RECORD, ▶, PAUSE

Monitor: TAPE

Record level regulator VR 402 or VR 402' fully counterclockwise.

Set minimum voltage at connection jack line – output L + R using coils filter 101 or 101' (suppression of the HF crosstalk between record and playback head).

Cr II, RECORD, ▶

Monitor: SOURCE

Set record level regulator VR 402 or VR 402' fully clockwise.

Supply 400 Hz at –20 dB to the VU meters via the LINE input from the AF oscillator.

Monitor: TAPE

400 Hz and 10 kHz with –20 dB (VU meter). Using VR 301 or VR 301' (HF bias) adjust for uniform level of both frequency sections. The output voltage at the AF oscillator must be the same in the case of both frequencies.

Note: only carry out slight adjustment as the bias point is already preset.
The affect of HF bias on the 10 kHz –20 dB level may be directly observed via off-tape monitoring.

Less HF = treble emphasis
More HF = treble deemphasis

Insert test cassette, Fe-reference medium section (e. g. BASF LH-Super)

Fe, RECORD, ▶

Monitor: TAPE

Set the bias point for Fe tape using VR 202 in the same way (operates on the R + L channel).

Insert test cassette, FeCr-reference medium section (e.g. Sony-Ferrichrom).

FeCr, RECORD, ▶

Monitor: TAPE

Set the bias point with VR 203 (operates on the R + L channel).

Record level

Insert test cassette, Cr II-reference medium section (e. g. Maxell UD-XL II)

Cr II, DOLBY NR, MPX, RECORD, ▶

Level control VR 402 or VR 402' open (fully clockwise).

Monitor: SOURCE

Record 400 Hz with 0 dB (VU meters).
Output voltage at cynch output L + R = 580 mV.

Monitor: TAPE

Set an output voltage of 580 mV using VR 106 (left channel) and VR 106' (right channel).

Insert test cassette, Fe-reference medium section (e. g. BASF LH-Super). Repeat the same procedure with Fe-reference medium section and set 580 mV output voltage using VR 105 or VR 105'.

Insert test cassette, FeCr-reference medium section (e. g. Sony-Ferrichrome).

Repeat the same procedure with FeCr-reference medium section and set 580 mV output voltage using VR 107 or VR 107'.

Limiter

Fe, RECORD, DOLBY NR, MPX, ▶

Monitor: SOURCE

LINE/DIN level controls VR 402 and VR 402' open (fully clockwise).

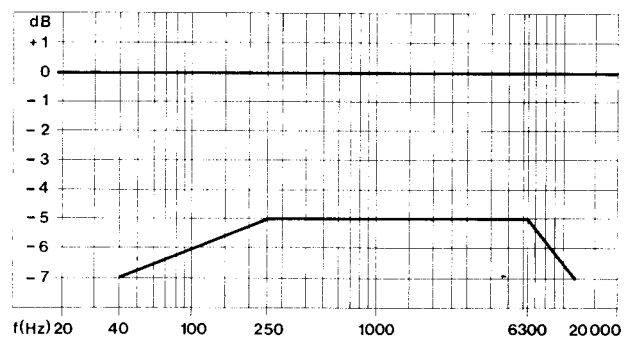
Supply 400 Hz + 1 dB (VU meters) to the input.

Switch on limiter.

Set 0 dB at the VU meters using VR 108 or VR 108'. The voltage at output L and output R must be 580 mV.

Overall frequency responses

The overall frequency responses for all types of tape must lie within the specific tolerances in accordance with DIN 45 500, sheet 4. The recordings are made at a level of approximately 26 dB beneath 0 dB on the VU meter.



Bottom Limit Frequency = 40 Hz
Top Limit Frequency = 12,5 kHz

Safety regulations

Servicing of electronic equipment should be performed only by authorized service staff.
During service the unit has to be operated with an insulated transformer.
Safety requirements (e.g. VDE 0860 H) have to be strictly observed during repair.

In order to maintain safety, the original design of the unit should not be altered, e. g. cover plates, mechanically secured wiring, tracking and insulating distance in air etc.
Use only DUAL spare parts for replacements.
Upon completion of repair make shure that all accessible and conductive parts do not carry mains voltage.

Fig. 5 Alignment positions

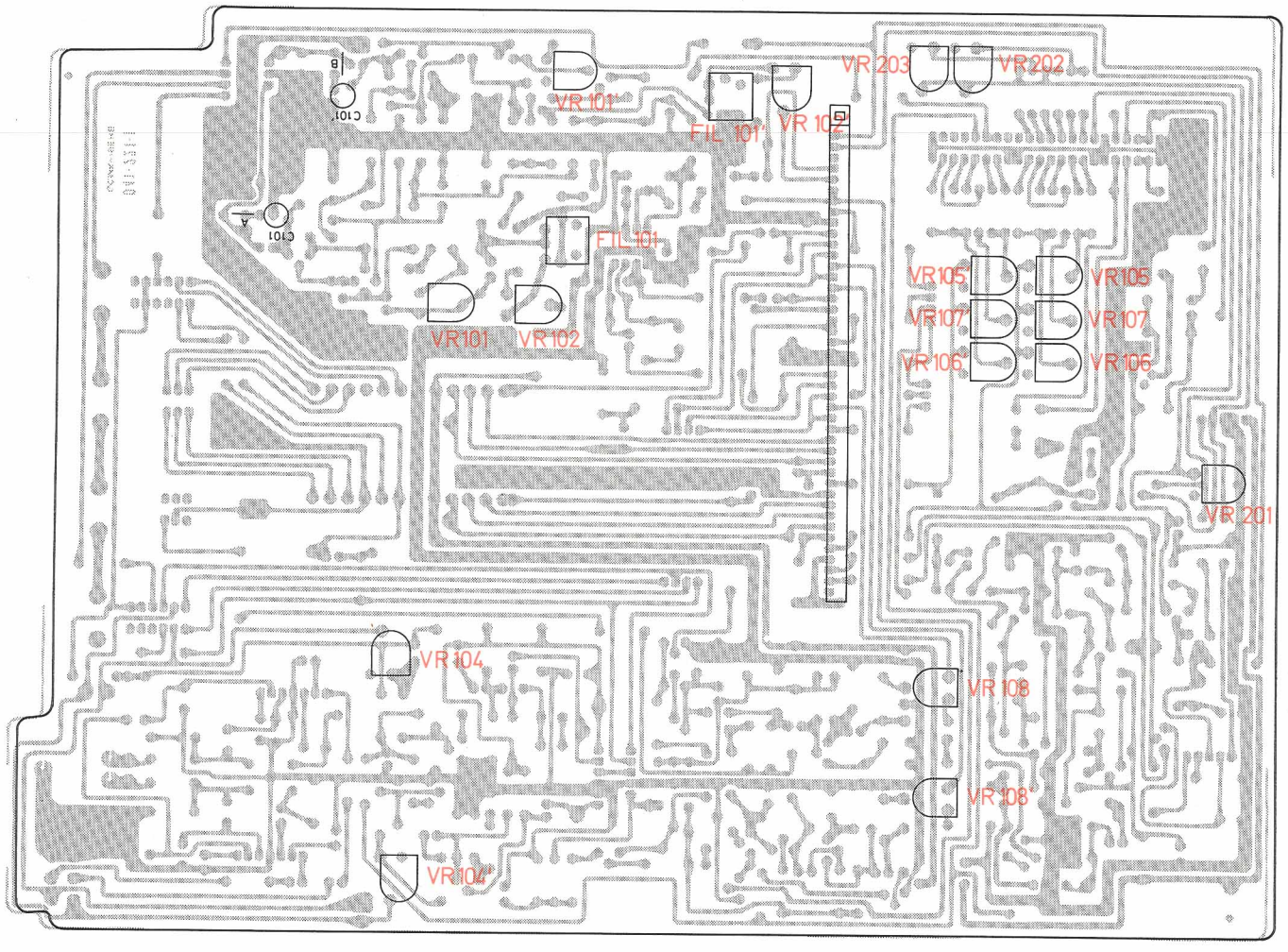


Fig. 6 Base plate (264 108) printed wiring side

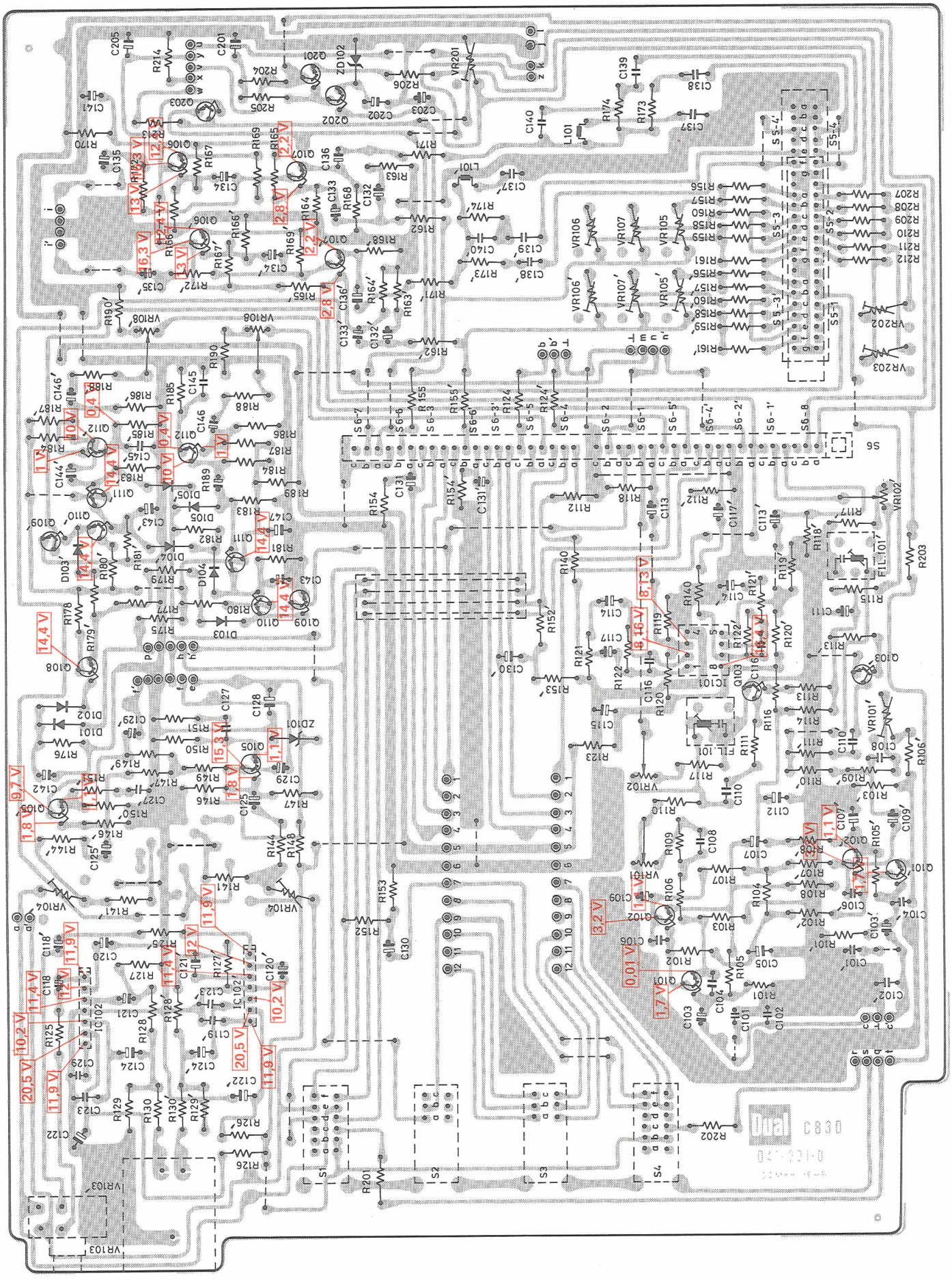


Fig. 7 Mixer plate (264 098) printed wiring side

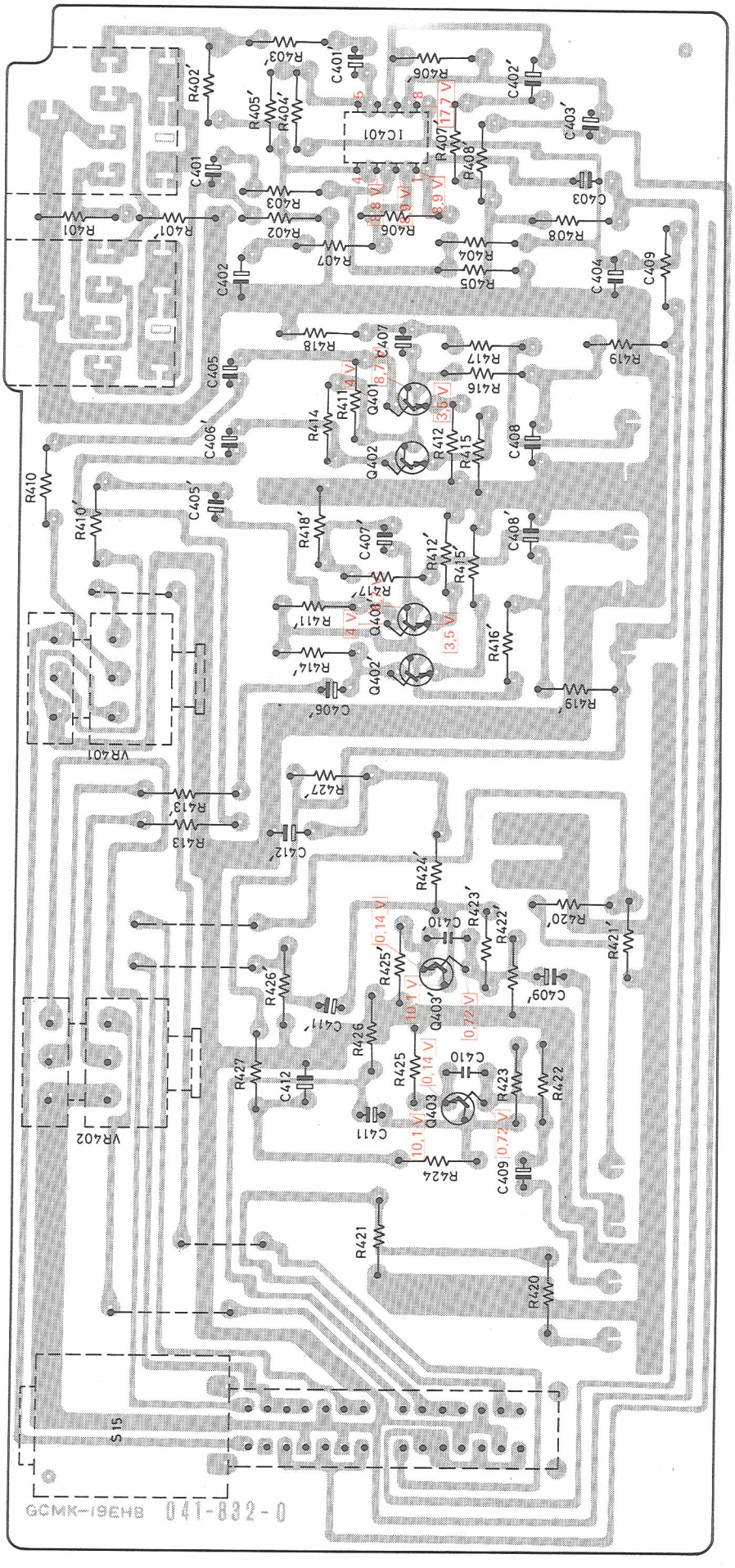


Fig. 8 Oscillator plate (264 097) printed wiring side

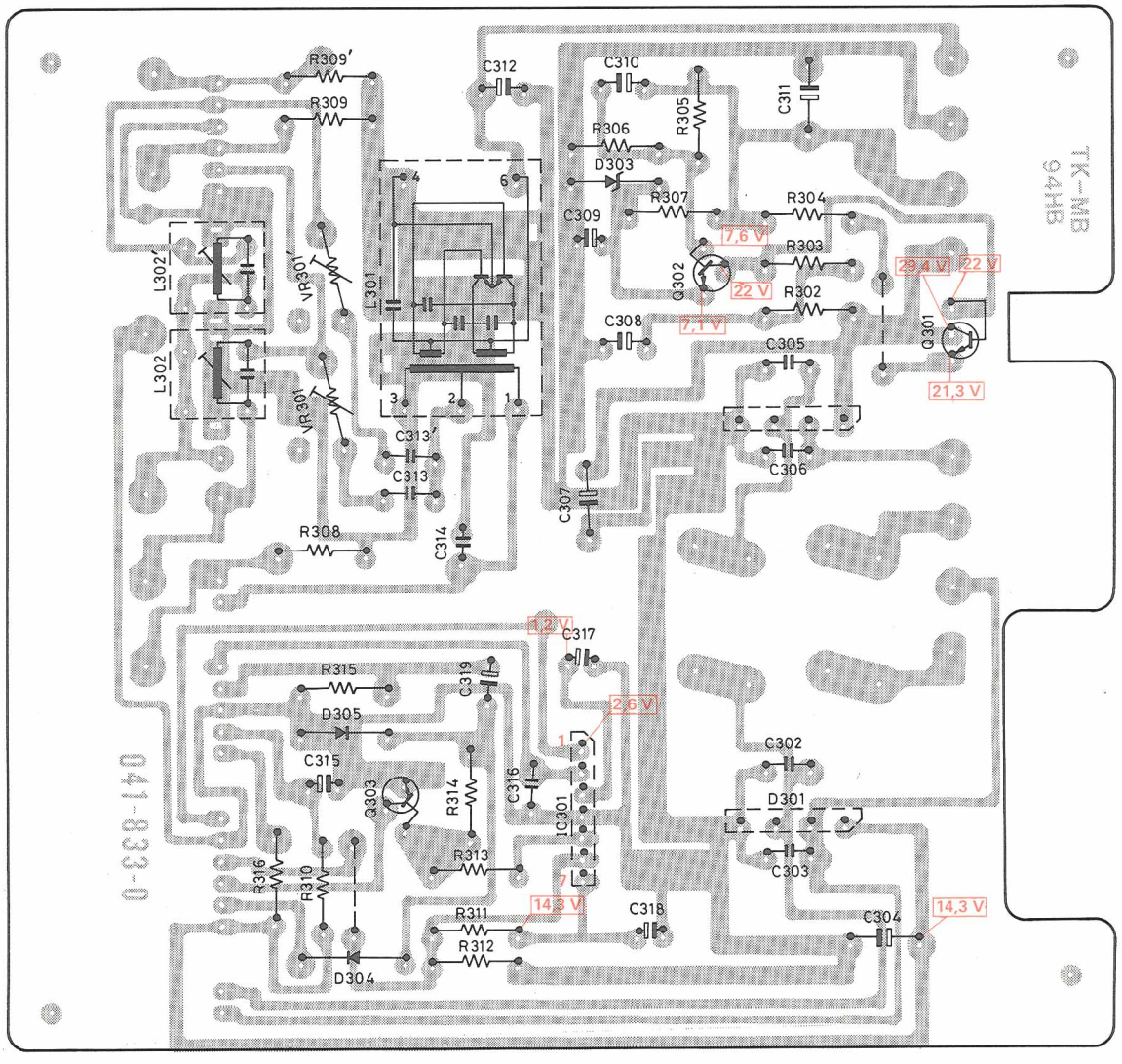


Fig. 9 LED-Indicator plate (264 109) printed wiring side

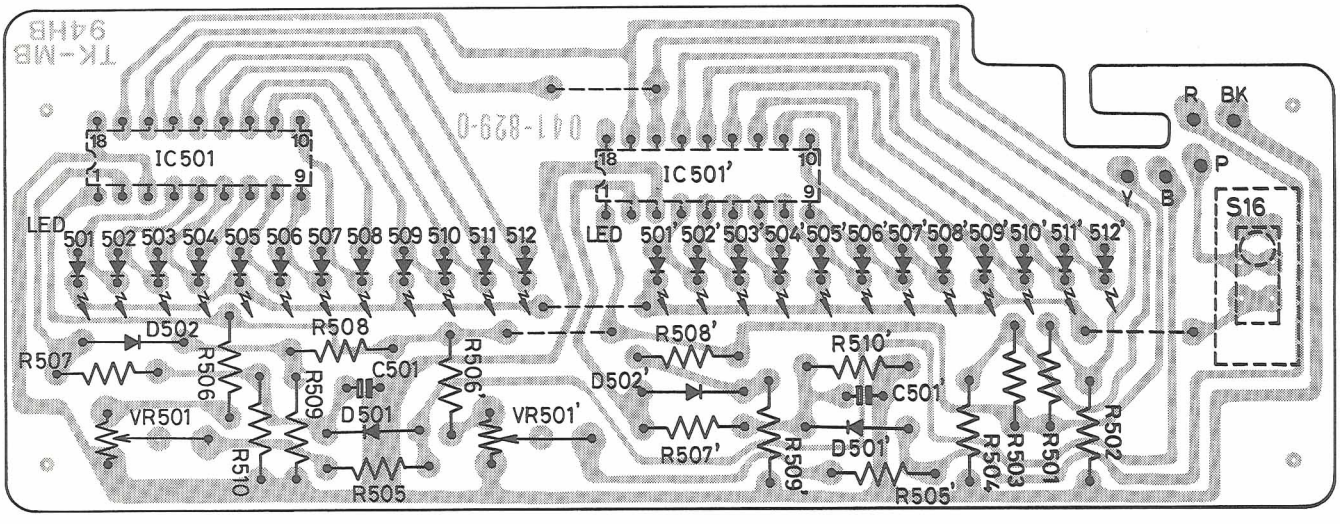


Fig. 10 Dolby-Amplifier plate (264 107) printed wiring side

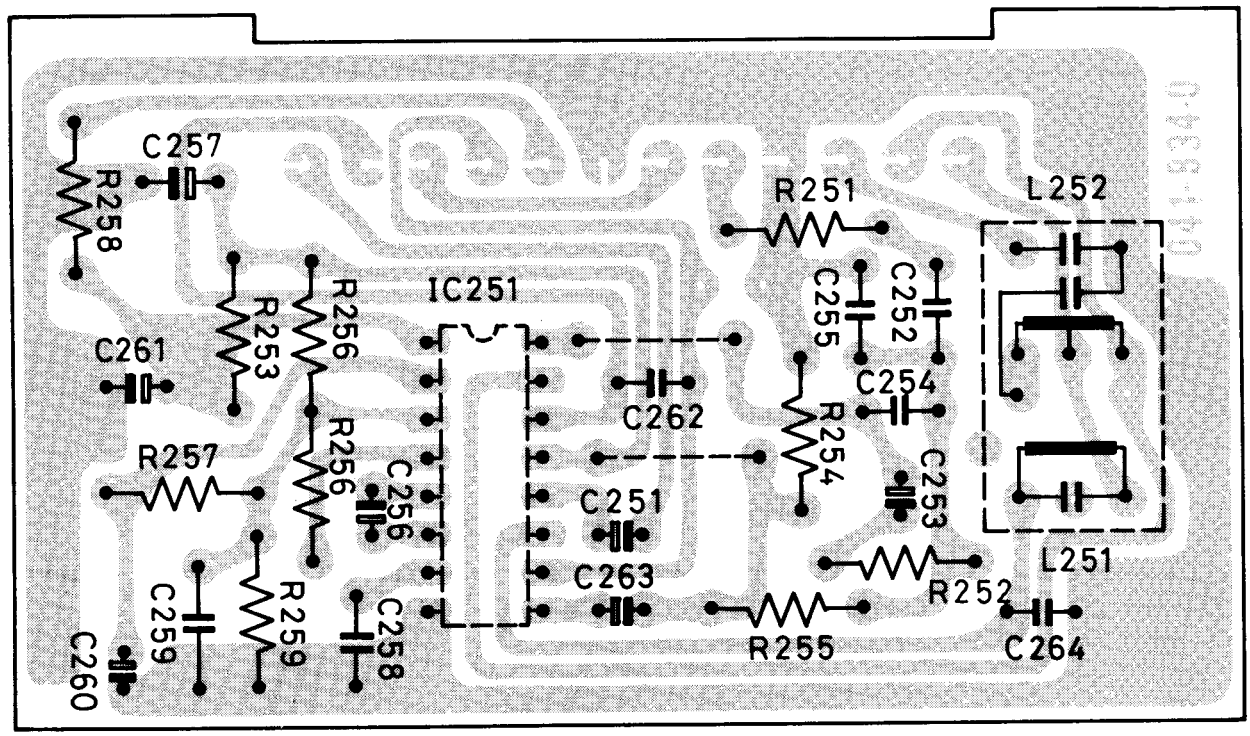


Fig. 11 Connection bush plate (264 103) printed wiring side

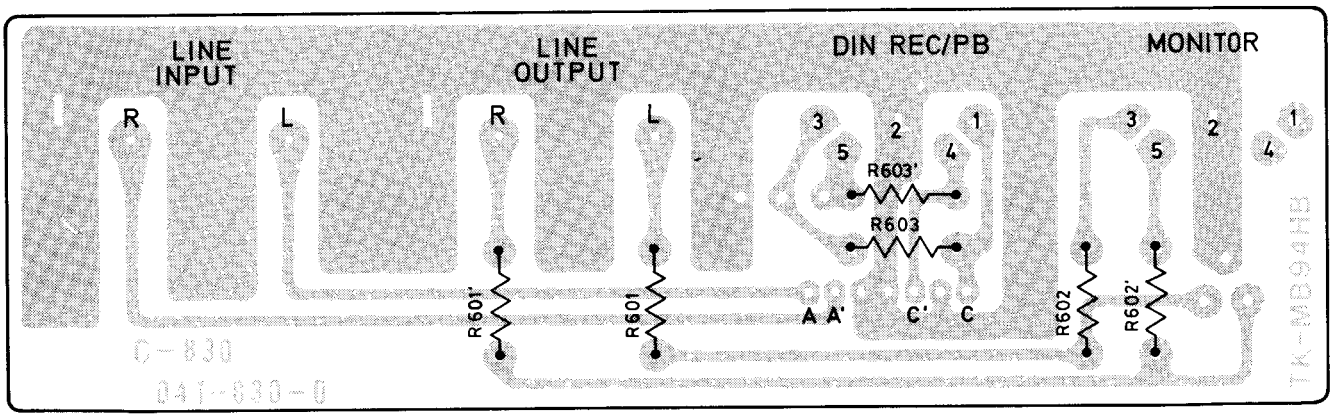
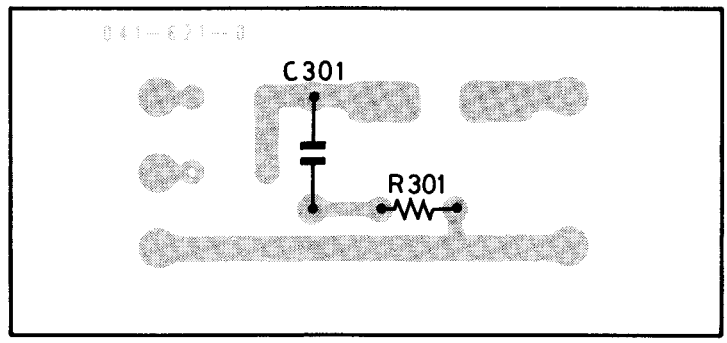


Fig. 12 Power plate (262 925) printed wiring side



WIRING DIAGRAM

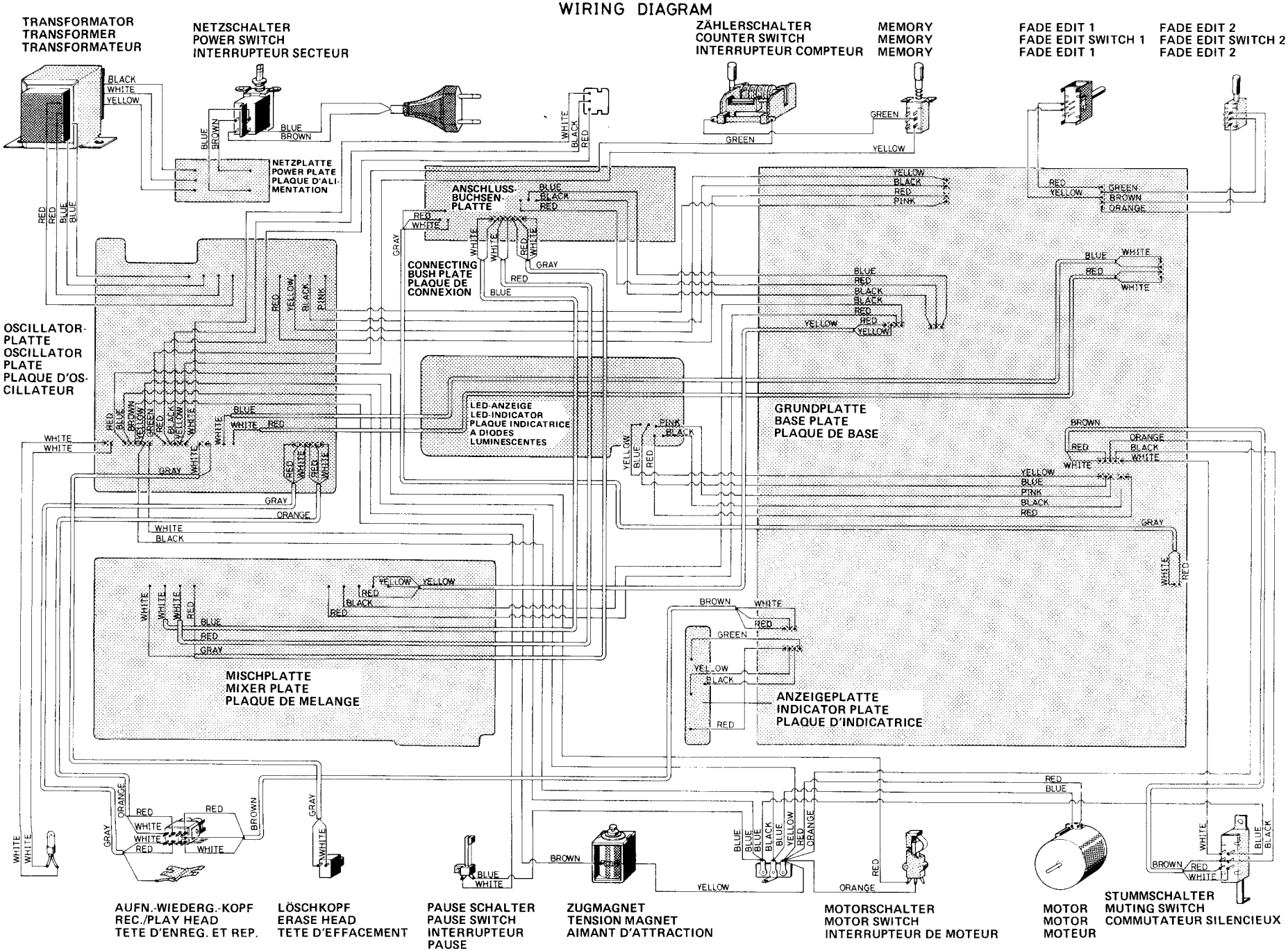


Fig. 13 Wiring shema

Mechanical section

General notes

The item numbers stated refer to the lists of replacement parts and exploded diagrams below.

1. Removing the housing 1 and the base plate

Remove the four machine screws **2** and the four washers **3**. Withdraw the housing **1** from the rear.
In order to remove the base plate, the four machine screws **56** on the lower section of the unit must be loosened and the supporting feet **54** plus the three self-tapping screws must be removed.

2. Removing the front trimplate

Remove the housing **1** as described above.
Withdraw the rotary switches **21**, **25** and **26** plus **27**. The four push buttons **20** must also be removed.
The six countersunk head screws **19**, three on the front trimplate upper section and three on the lower section must be removed. The front trimplate **18** can now be removed.

3. a) Removing the cassette holding plate 117

When carrying out repairs on the mechanical section, we recommend that the cassette holding plate **117** together with both stop keys **116** be removed. The most practical method of removing the above parts is to proceed as follows:
Press the connecting spindle **12** into the bearing spindle **10** and remove it. Raise the head cover **118**. Disengage both cassette holding plate retaining lugs **L** from the plate with the aid of a screwdriver. Carefully remove the cassette holding plate **117** from the unit and then remove the bulb **114** together with the rubber sleeve.

b) Disengaging the probing lever on the cassette holder 123

In order to check proper functioning of playback or quick wind/rewind without inserting a cassette, the probing lever **F** on the cassette holder **123** must be disengaged as follows: Depress the playback key or the fast wind/rewind key and then disengage the probing lever **F** on the left cassette holder **123** by pressure so that the key clicks into position.

4. Motor

a) Replacing the motor
In order to replace the motor **154**, the motor belt and the flat belt must firstly be removed from the drive pulley **141**. Rotate the motor in a counterclockwise direction (bayonet catch) and remove the motor **154**.
Unsolder the connection leads from the printed circuit board.
Loosen the grub screw and remove the drive pulley **141**.
Unscrew the motor retaining plate **154** and secure it onto the new motor.
Place the drive pulley **141** onto the spindle of the new motor **154**. Set a clearance of approximately 0.3 mm between the drive pulley **141** and the motor retaining plate and then tighten the grub screw (Fig. 7).
Solder on the connection leads to the printed circuit board (red = +).
Insert the motor into the unit and lock it in position by rotating it in a clockwise direction (bayonet catch). Fit the flat belt and motor belt to the drive pulley **141**.

b) Motor speed – tape speed
Measurement procedure is the same as that described in section 6, "WOW and flutter". The tape speed may be set withe the aid of an insulated screwdriver at the rear of the motor (Fig. 2).
The speed is correctly adjusted when a maximum deviation of −1 to +0.5 % is measured.

5. Drive belts

In order to change defective drive belts, you should proceed as follows (refer to figure 8 – belt diagram):
The motor belt **A** can be removed or replaced without further difficulty. Remove the three machine screws **183** and the base plate **155**. The flat belt **B** and the counter belt **C** may now be replaced.
Draw out the flywheel **144** from the bearing bush.

Fig. 14

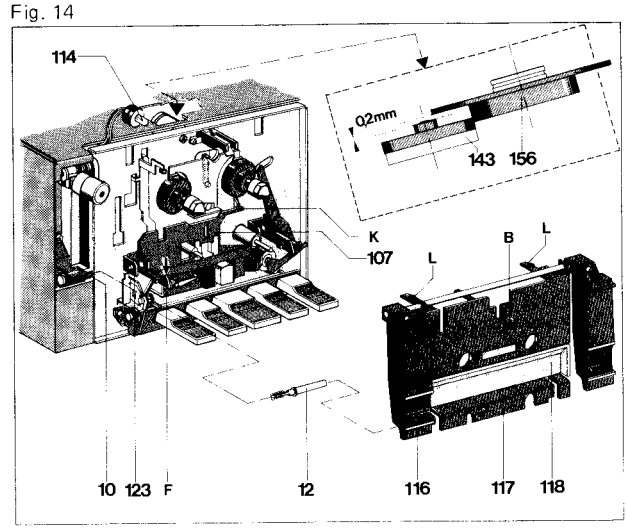


Fig. 15

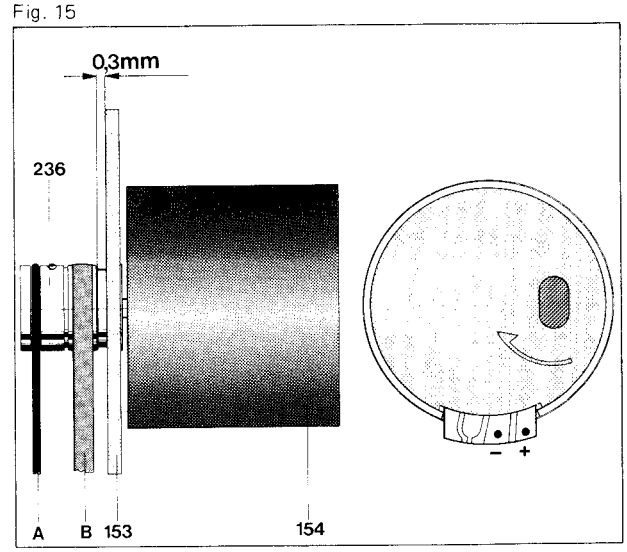
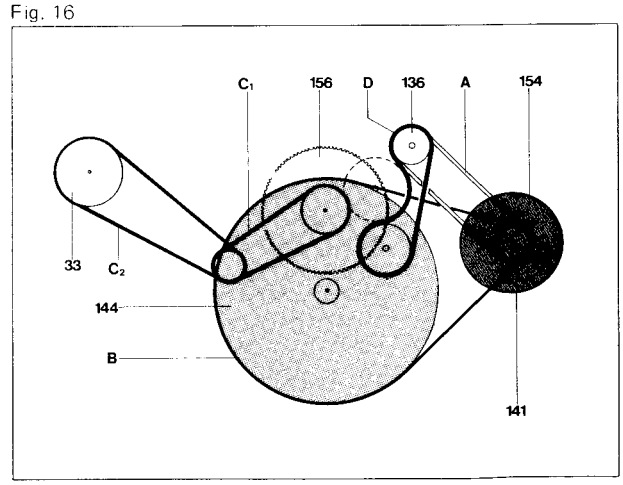


Fig. 16



Attention! The plastic washer **174** at the front side of the unit will drop off.
The counter belt **C 2** and the tape-up belt **D** may now be replaced. Once the belts have been fitted, the polyethylene washer **174** must be fitted on the spindle (capstan) of the flywheel **144**. Furthermore, it is advisable to press the fast forward or reverse wind key and clean the capstan and the drive belt with a cloth soaked in methylated spirit.

6. a) WOW and flutter

Measure with a WOW meter (e. g. Woelke ME 101, ME 104 or Franz EMT 420 A) and WOW test cassette 3150.

Setting of the test instrument: 0.3 % measurement range, weighted.

In order to avoid incorrect measurement caused by jamming tape travel we recommend that the test cassette be rapidly wound and rewound occasionally.

Typical values for the Dual cassette deck (playback)
±0.08 – 0.12 %
Individual higher deflections should not be weighted as they are the results of bad tape-head contact caused by detrition, dust or felt particles.

If necessary, check the following points:
a) Clean the pinch roller and capstan
b) Check the pinch roller for free movement
c) The take-up torque, which is adusted at the coupling, should be 6.0 ± 1 mN m (60 ± 10 pcm). Slightly fluctuating values do not affect the WOW. At the same time, the torque on the non-driven side should be 0.1 – 0.2 mN m (1 – 2 pcm). A higher or varying value suggests that the bearing on the left winding gear is defective.
d) Replace the flat belt or the flywheel

Fig. 17

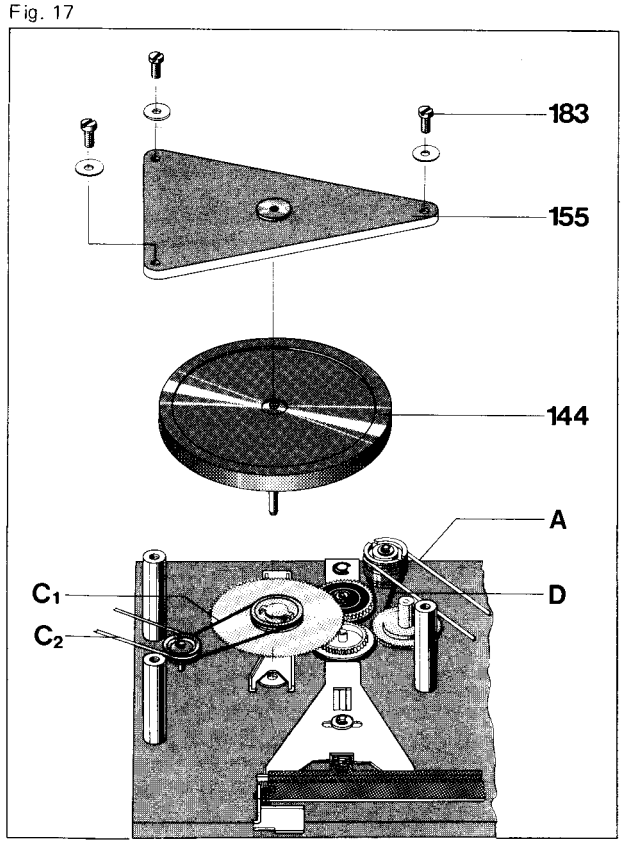
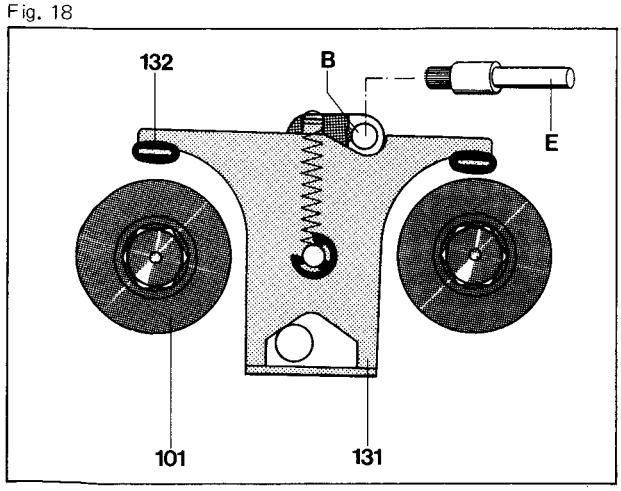


Fig. 18



b) Tapebrake

In order to achieve anoptimal contact between tape and head, the tape is braked by brakearm **163** and with felt **164** of the mounting plate compl. **160** with 1.2 – 1.5 mN m * (12 – 15 pcm).
Checking has to be done with a loose piece of tape which has to be pulled between brakearm **163** and mounting plate **160** by using a the spring balance.
Adjusting the brakeforce by bending the V-spring **162**.
*0.1 mN m = 1 pcm

7. Pressure lever

The pressure lever **128** and the V-spring **127** may be removed once the lock washer **167** has been loosened. Refitting involves the reverse procedure. Take particular care to see that the V-spring **127** is refitted in the same position as before.
With the "Pause" key disengaged (unit switched to play), the pinch roller should be pressed by the V-spring **127** against the capstan with a force of (450 p $\pm \frac{100}{50}$ p). If necessary, this must be adjusted by retensioning the V-spring **127**.
The test cassette (Dual item no. 232 797) may also be used to check the pressure lever **128** for proper functioning in the following manner:
Insert the test cassette and depress the playback key. Slowly brake the driver assembly **101** on the supply reel side until it stops. Tape tension should be less than 10 mN m (100 pcm).
With the pause key engaged and the start key fully depressed, there should be a clearance of 0.4 – 1 mm between the capstan and the pinch roller. This may be adjusted by bending the pressure lever.

8. Brake plate

When replacing the rubber sleeves **122** on the brake plate **131**, please note the following:
During fast wind/rewind, there must be a clearance on the supply reel side of 0.1 – 0.2 mm between the rubber sleeve and the brake drum on the driver assembly complete **101**. If necessary, the lugs on the brake plate **131** should be bend slightly (Fig. 10).

9. a) Coupling

To ensure satisfactory winding, the take-up torque of the coupling must be correct. The take-up torque should be 6.0 ± 1 mN m (60 ± 10 pcm) when measured with a test cassette (Dual item no. 232 797). Readjustment of the entire unit may be carried out as follows:

1) Isolate the unit from the mains by removing the power cable.
2) Depress the fast rewind key (<<).
3) Rotate the left driver assembly **101** until one of the two adjustment holes becomes visible through the hole **B** in the cassette holder plate (Fig. 10). Then, using the special adjustment spanner **E** (Dual item no. 230 933) adjust the take-up torque. Rotating in a clockwise direction will increase the take-up torque whereas rotating in a counter-clockwise direction will decrease it.

b) Torque on the coupling pulley

In order to ensure uniform torque during fast wind/rewind, the upper section of the coupling pulley **136** must be separated from the lower drive diameter of the take-up belt by means of a release-type clutch (Fig. 11).

Inspection:

Insert the special torque measurement cassette (Dual item no. 238 600). Depress the rapid wind or rewind key. Measure the value several times and, after each measurement, the cassette should be briefly removed and replaced so that both scales read 0. The torque should be between 8 and 13 mN m (80 – 130 pcm) (a typical value in the case of a new drive pulley is between 9 and 14 mN m (90 – 140 pcm). If necessary, the coupling pulley **136** should be held in position. Adjust the release-type coupling as necessary with the aid of a spanner or flat-nosed pliers.

Note: the motor belt **A** must show no signs of slip, or dirt etc.

10. Fast rewind

There should be a clearance of at least 0.2 mm between the right winding gear **156** and the coupling pulley **143.** If necessary, the lug **K** on the head mounting assembly plate **107** should be bend slightly (refer to Fig. 6).

11. Record lever

The record lever should be adjusted so that, with the record key depressed, the record/playback switch **S 1** moves to its stop. Adjustment should be carried by bending the record lever.

12. Record/playback head, erase head

When replacing the record/playback head **103** you must take the following preliminary adjustment measures:
Fit the record/playback head **103** together with the flat spring on the head assembly and then secure it with the bushes and machine screws **Z** in such a way that the tape guides **B** are in line with the tape guides on the head mounting assembly **B 1** and the erase head **B 2** (Fig. 12). The section entitled "electrical alignment" describes the procedure for fine adjustment.

13. Cleaning/lubrication

Always clean the unit when servicing or repairing it.
In order for the unit to function properly, the record/playback head **103**, the erase head **102**, the pinch roller **128** and the capstan should always be perfectly clean. These parts are best cleaned using a cotton cloth or cotton bud soaked in methylated spirit. On no account should you use metal objects to clean the unit. Furthermore, the surface of the magnetic head should never be touched with bare fingers.
All bearing and sliding points on the unit are adequately lubricated at the factory. Relubrication is normally not necessary for several years, since most important parts are provided with oil retainers. The motor bearings are provided with long-life oil retainers and therefore require no lubrication.

Fig. 19

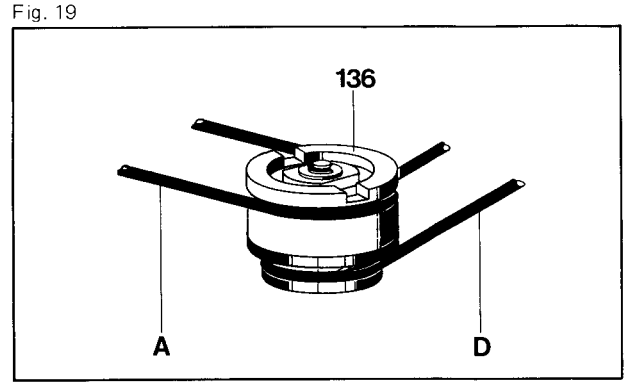


Fig. 20

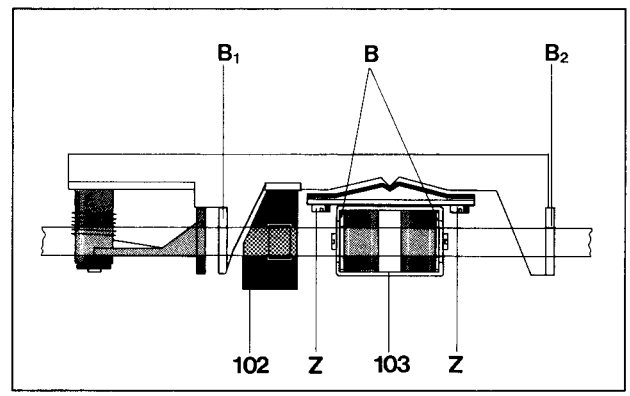
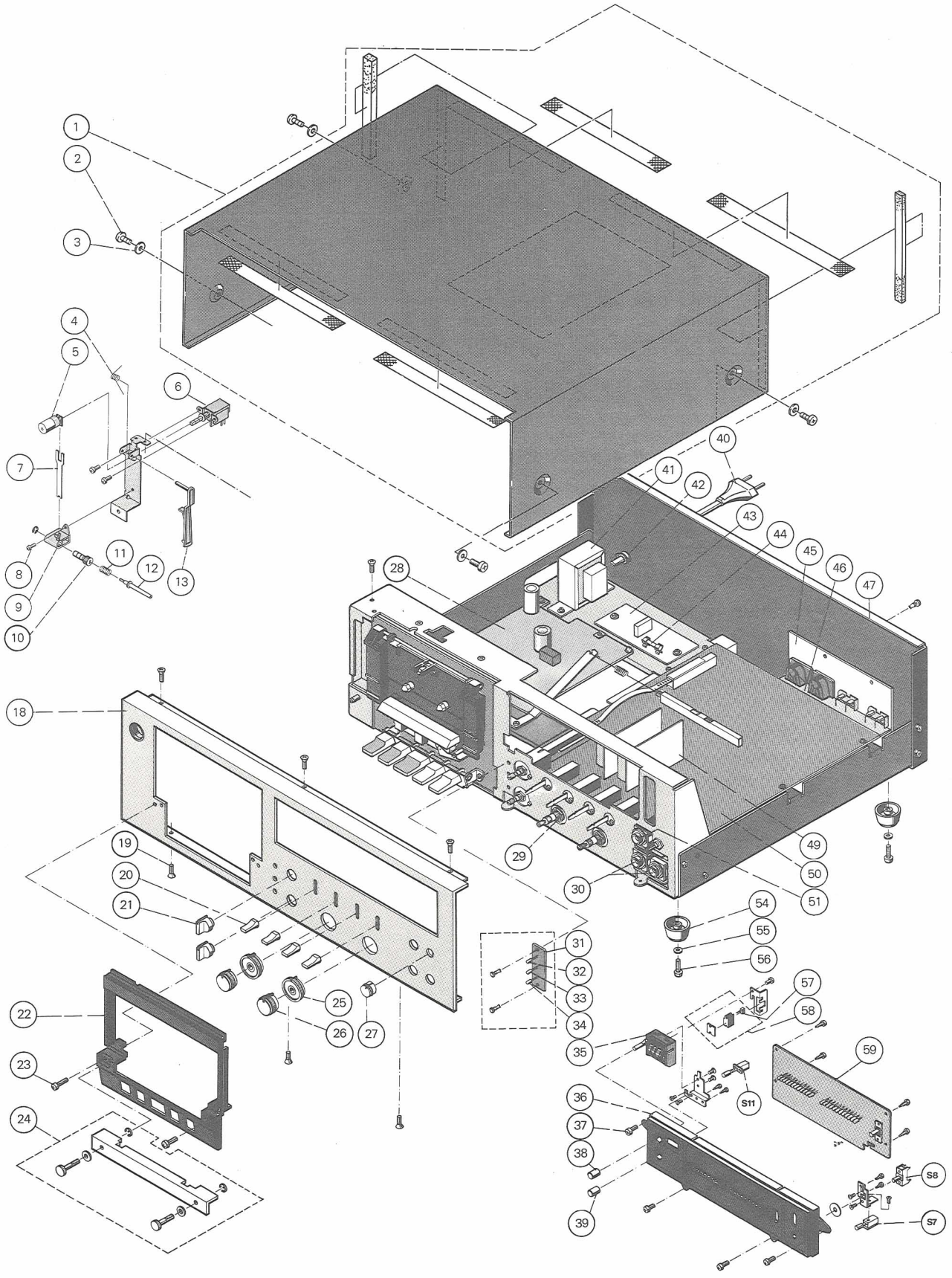


Fig. 21 Exploded diagram 1

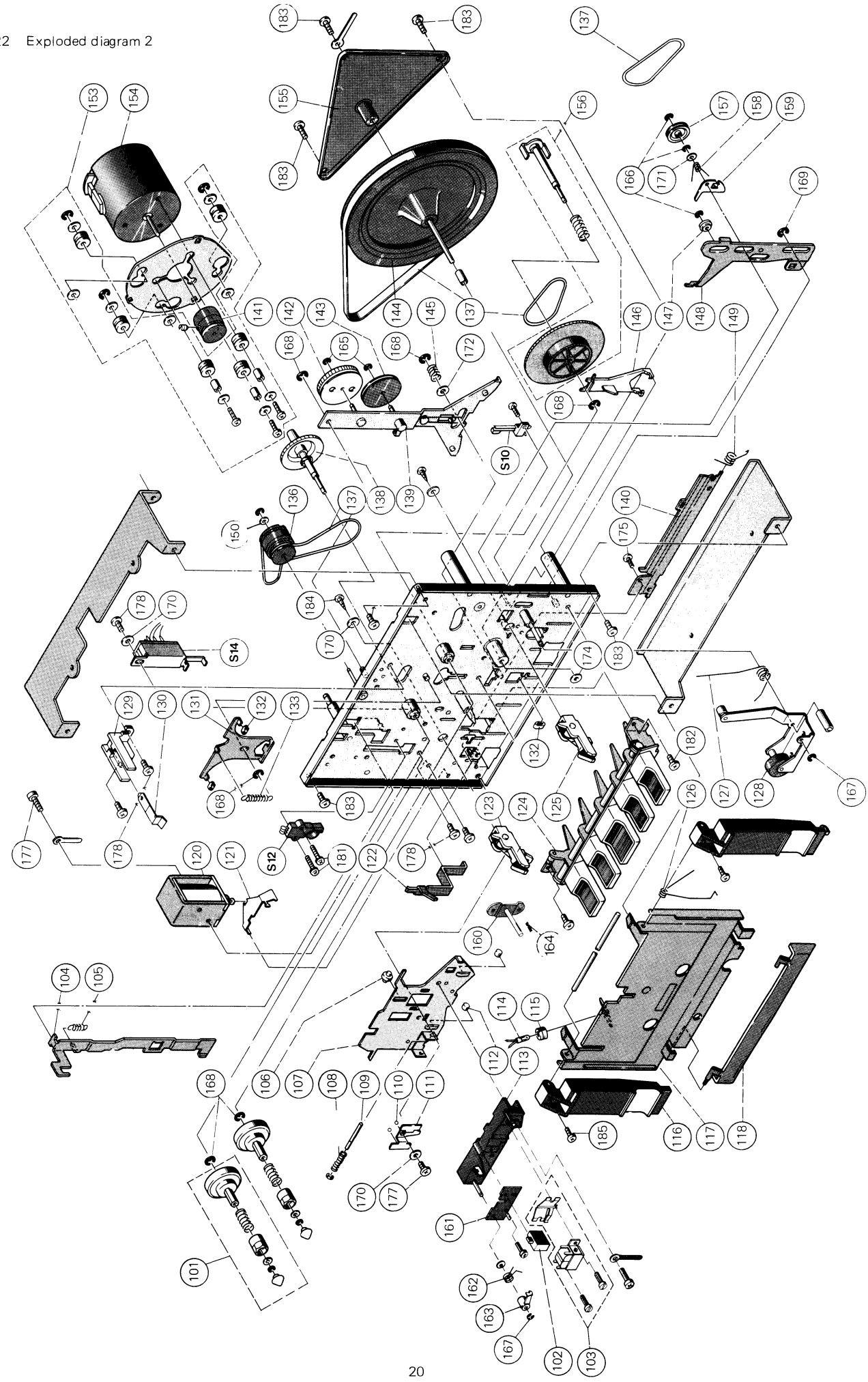


Replacement parts

Pos.	Part.No.	Qty	Description
1	263 040	1	Housing complete
2	226 856	4	Machine screw M 4 x 8
3	239 049	4	Washer 4.3
4	262 946	1	V-spring
5	263 010	1	Push button
6	262 913	1	Power switch Europe
	262 914	1	Power switch Canada/USA
7	262 969	1	Flat spring
8	210 480	2	Machine screw M 3 x 6
9	263 006	1	Bearing bracket
10	263 007	1	Bearing spindle
11	262 948	1	Pressure spring
12	262 992	1	Connecting spindle
13	263 005	1	Bearing lever
18	264 095	1	Front trimplate metallic-silver complete
	264 096	1	Front trimplate metallic-brown complete
19	203 475	10	Countersunk head screw M 3 x 8
20	263 000	1	Push button
21	262 999	1	Rotary switch
22	263 045	1	Front frame complete
23	210 488	2	Machine screw M 3 x 12
24	263 046	1	Head cover
25	264 081	2	Rotary switch R
26	264 082	2	Rotary switch L
27	264 497	1	Rotary switch (phones)
			Oscillator board
28	264 097		Oscillator board complete
D 301	263 037	2	DR SV B 10–100
D 302	263 037	2	DR SV B 10–100
D 303	264 088	1	DZ HZ 7 B–2
D 304	209 867	1	1 N 60
D 305	264 086	1	DD MA 150
T 301	264 092	1	2 SC 2594–A
T 302	263 025	1	2 SC 828–S
T 303	263 027	1	2 SC 1383 NC–S
IC 301	263 030	1	IC AN 6250
VR 301	229 911	2	Trimmer 50 kΩ
L 301	264 057	1	Oscillator coil
L 302	262 905	1	Coil
Sl 1	209 725	1	G fuse insert T 630 mA/250 V
Sl 2	209 724	1	G fuse insert T 315 mA/250 V
			Mixer board
29	264 098	1	Mixer board complete
30	264 053	2	Mic jack
S 15	264 056	1	Switch (input selection)
T 401	264 114	4	2 SC 1327–R
T 402	264 114	4	2 SC 1327–R
T 403	263 026	2	2 SC 1327–U
VR 401	262 911	2	Volume regulator 50 kΩ
VR 402	262 911	2	Volume regulator 50 kΩ
IC 401	263 031	1	IC NJM 4548
			Indicator board
31	264 099	1	Indicator board complete
32	263 039	1	LED TLG 124 green
33	264 090	1	LED TLY 124 yellow
34	263 038	1	LED RLR 124 red
35	262 968	1	Counter complete
36	264 100	1	LED indicator frame
37	210 480	4	Machine screw M 3 x 6
38	263 002	1	Counter button
39	263 001	1	Memory button
40	243 750	1	Power cable Europe
	232 995	1	Power cable USA
41	264 101	1	Power transformer Europe
	264 102	1	Power transformer Canada/USA
42	237 548	1	Cable duct with pull-relief
43	262 925	1	Power board unequipped Europe
	262 926	1	Power board unequipped Canada/USA

Pos.	Part.No.	Qty	Description
44	209 710	1	G fuse insert T 80 mA/250 V
45	264 103	1	Connection jack board complete
46	264 104	1	Connection jacks complete
47	264 105	1	Rear panel complete Europe
	264 106	1	Rear panel complete Canada/USA
			Dolby amplifier board
49	264 107	2	Dolby amplifier complete
L 251	264 058	1	MPX filter coil
IC 251	247 656	1	Integrated circuit LM 1011
			Base plate
50	264 108	1	Base plate complete
51	264 052	1	Headphone jack
D 101	264 086	8	DD MA 150
D 102	264 086	8	DD MA 150
D 103	264 086	8	DD MA 150
D 104	264 086	8	DD MA 150
D 105	264 086	9	DD MA 150
ZD 101	264 089	1	DZ HZ 15–3
ZD 102	264 087	1	DZ HZ 4 B–2
FL 101	262 905	1	Filter coil 12.7 mH
L 101	265 289	1	Coil 2.2 mH
S 1	262 921	1	Switch (monitor)
S 2	264 115	1	Switch (limiter)
S 3	264 115	1	Switch (MPX)
S 4	262 921	1	Switch (Dolby)
S 5	264 116	1	Switch (tape selector)
S 6	264 117	1	Switch (record/playback)
T 101	263 026	4	2 SC 1327–U
T 102	263 026	4	2 SC 1327–U
T 103	263 025	18	2 SC 828–S
T 104	263 025	1	2 SC 828–S
T 105	263 025	18	2 SC 828–S
T 106	263 025	18	2 SC 828–S
T 107	263 025	18	2 SC 828–S
T 108	263 025	18	2 SC 828–S
T 109	263 025	18	2 SC 828–S
T 110	263 025	18	2 SC 828–S
T 111	263 025	18	2 SC 828–S
T 112	263 025	18	2 SC 828–S
T 201	265 290	1	2 SC 2594–S
T 202	263 025	18	2 SC 828–S
T 203	264 091	1	2 SD 965–R
IC 101	236 299	1	IC 4558
IC 102	264 094	1	IC TA 7066 P
VR 101	229 938	5	Trimmer 5 kΩ
VR 102	228 231	4	Trimmer 10 kΩ
VR 103	264 533	4	Trimmer Volume 20 kΩ
VR 104	228 231	4	Trimmer 10 kΩ
VR 105	238 092	4	Trimmer 2 kΩ
VR 106	229 938	5	Trimmer 5 kΩ
VR 107	238 092	4	Trimmer 2 kΩ
VR 108	263 041	4	Trimmer 20 kΩ
VR 201	229 938	5	Trimmer 5 kΩ
VR 202	227 265	2	Trimmer 1 kΩ
VR 203	227 265	2	Trimmer 1 kΩ
54	262 949	4	Support foot
55	210 586	4	Washer 4.3
56	210 492	4	Machine screw M 3 x 15
57	263 029	1	IC DN 6838 (IC 302)
58	263 055	1	Tape motion monitor complete
			LED indicator board
59	264 109	1	LED indicator board complete
60	225 323	4	Fillister-head screw B 2.9 x 8
D 501	264 086	4	DD MA 150
D 502	264 086	4	DD MA 150
S 7	264 054	1	Switch (Fade Edit)
S 8	264 055	1	Switch (Fade Edit)

Fig. 22 Exploded diagram 2



Pos.	Part.No.	Qty	Description
S 11	246 769	1	Switch (Memory)
S 16	262 917	1	Switch (Ein/Aus)
IC 501	235 848	1	UAA 180
VR 501	227 365	1	Trimmer 1 kΩ
LD 501	263 039	14	LD TLG 124 green
LD 502	263 039	14	LD TLG 124 green
LD 503	263 039	14	LD TLG 124 green
LD 504	263 039	14	LD TLG 124 green
LD 505	263 039	14	LD TLG 124 green
LD 506	263 039	14	LD TLG 124 green
LD 507	263 039	14	LD TLG 124 green
LD 508	263 038	10	LD TLR 124 red
LD 509	263 038	10	LD TLR 124 red
LD 510	263 038	10	LD TLR 124 red
LD 511	263 038	10	LD TLR 124 red
LD 512	263 038	10	LD TLR 124 red
101	263 058	2	Driver complete
102	264 111	1	Erase head complete
103	264 110	1	Record/playback head complete
104	262 959	1	Record rail
105	262 939	1	Tension spring
106	262 971	1	Pulley B
107	264 070	1	Head assembly plate
108	262 942	1	Pressure spring
109	262 950	1	Spindle
110	209 353	2	Ball ϕ2
111	262 966	1	Stop spring
112	262 970	2	Pulley A
113	264 069	1	Head mount
114	264 059	1	Lamp
115	228 209	1	Rubber sleeve
116	263 060	2	Stop key
117	264 496	1	Cassette holder plate
118	264 085	1	Head sight
120	263 063	1	Tension magnet
	227 344	1	Diode 1 N 4001
121	262 958	1	Release
122	262 965	1	Stop arm
123	262 984	1	Cassette holder left complete
124	263 064	1	Keyboard
125	262 985	1	Cassette holder right complete
126	262 947	1	V-spring
127	262 945	1	V-spring
128	263 065	1	Pressure lever compl.
129	262 986	1	Cassette stop
130	262 967	1	Flat spring
131	262 961	1	Brake plate
132	262 989	3	Rubber sleeve
133	262 938	1	Tension spring
136	263 066	1	Coupling pulley complete
137	264 112	1	Set of belts complete

Pos.	Part.No.	Qty	Description
138	263 068	1	Winding gear left complete
139	262 954	1	Main lever
140	262 957	1	Locking plate
141	263 069	1	Drive pulley
142	262 974	1	Coupling
143	262 975	1	Intermediate gear
144	263 070	1	Disc flywheel
145	262 941	1	Pressure spring
146	262 953	1	Coupling lever
147	262 973	1	Spacing bush
148	262 955	1	Pause lever
149	262 944	1	V-spring
150	265 557	1	Washer 1,5/5/0,5
153	245 770	1	Motor fixing parts
154	245 769	1	Motor complete
155	263 071	1	Bottom plate complete
156	263 042	1	Winding gear right complete
157	262 988	1	Intermediate gear
158	262 943	1	V-spring
159	262 956	1	Switch latch
160	264 072	1	Mounting plate complete
161	264 071	1	Brake arm plate
162	264 062	1	V-spring
163	264 074	1	Brake arm
164	264 506	1	Felt (for Pos. 160)
165	210 142	1	Lock washer 1.2
166	210 143	6	Lock washer 1.5
167	210 144	1	Lock washer 1.9
168	210 145	7	Lock washer 2.3
169	210 146	4	Lock washer 3.2
170	210 586	5	Washer 3.2
171	210 549	1	Washer 2.1
172	257 138	1	Washer 3.7
173	243 237	1	Washer 1.5
174	210 556	1	Polyethylene washer 2,4/6/0.5
175	220 876	1	Machine screw M 2.6 x 3
176	223 774	4	Machine screw M 2.6 x 6
177	210 469	1	Machine screw M 3 x 3
178	210 472	6	Machine screw M 3 x 4
179	210 486	3	Machine screw M 3 x 8
180	210 488	2	Machine screw M 3 x 12
181	210 433	2	Machine screw M 2 x 8
182	210 475	2	Machine screw M 3 x 5
183	210 480	4	Machine screw M 3 x 6
184	213 471	2	Self-tapping screw B 2.9 x 6.5
185	217 616	2	Machine screw M 2.5 x 8
S 10	262 918	1	Switch minature
S 12	262 920	1	Contact
S 14	262 915	1	Slide switch
	246 964	1	Shipping carton
	260 881	1	Operating manual

Modification reserved!